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June 30, 2006

184256.FS.01

Mr. Dion Novak
Work Assignment Manager (SR-6J)
U.S. Environmental Protection Agency
77 West Jackson Boulevard
Chicago, IL 60604-3590

Dear Mr. Novak:

Subject: Technical Memorandum#1 –Feasibility Study Supplement for the
Eagle Zinc Company Site, Hillsboro, Illinois
WA No. 219-RSBD-B5Y7, Contract No. 68-W6-0025

Enclosed are five copies of the Technical Memorandum #1—Feasibility Study Supplement
for the Eagle Zinc Company Site, located in Hillsboro, Illinois.

If you have any questions, please do not hesitate to contact me, 314-421-0313 ext. 241.

Sincerely,

CH2M HILL

Lisa R. Cundiff
Site Manager

Enclosures

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Feasibility Study Supplement for the Eagle Zinc Company Site, Hillsboro, Illinois

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1 Introduction

This technical memorandum (TM) supplements the results of a feasibility study (FS; ENVIRON 2006b) conducted for the former Eagle Zinc Company Site (Eagle Zinc). ENVIRON International Corporation (ENVIRON) prepared the FS report on behalf of the Eagle Zinc Parties (the "Parties") as part of the remedial investigation (RI)/FS for the site. The RI/FS was conducted pursuant to the statement of work (SOW) contained in the December 31, 2001, Administrative Order on Consent (AOC) between the Parties and the United States Environmental Protection Agency (USEPA).

Eagle Zinc is approximately 132 acres in size, located in a mixed commercial/industrial and residential area in the northeastern part of Hillsboro, Illinois. Buildings cover approximately 10 to 15 percent of the surface of the site. Other principal site features include raw material and residual material stockpiles (ENVIRON 2004a).

CH2M HILL, on behalf of USEPA, updated the FS to reflect additional human health and ecological risk assessment conclusions conducted for the site. The results of the revised risk assessments are presented in this TM. Based on the risk assessment revisions, the following FS components required further consideration:

- Applicable or relevant and appropriate requirements (ARARs) of environmental laws and regulations identification
- Remedial action objectives (RAOs) development
- Preliminary remedial goals (PRGs) calculations
- Remedial alternatives development

A second TM will provide a detailed evaluation of the remedial alternatives presented in this TM. A summary of site conditions can be found in the RI conducted for Eagle Zinc (ENVIRON 2004a, 2006a).

2 Human Health Risk Assessment Summary

This summary of the site human health risks compiles information from the RI conducted for Eagle Zinc (ENVIRON 2004a, 2006a), the associated human health risk assessment (ENVIRON 2004b, 2004c), and the *Review of Nature, Extent of Contaminants, and Risk Assessments* (CH2M HILL 2005). This TM describes the receptors that could potentially become exposed to site contaminants, potentially significant exposure pathways, affected media, and contaminants of potential concern. In addition, this TM identifies contaminants and media that potentially could be human health risk drivers that may warrant development of PRGs.

2.1 Potential Contaminant Sources

From 1912 until 2001, Eagle Zinc was used as a zinc smelter and for manufacturing sulfuric acid, zinc oxide, and leaded zinc oxide. Residuals from plant operations were placed in residue piles at the site. The residue piles have been categorized based on the processes that generated them (ENVIRON 2004a). Some have a high proportion of non-erodible elements (that is, large pieces of residue) or are crusted at the surface, while others may contain up to 30 percent fine particulates (ENVIRON 2006a) that could be transported as wind-blown dust or as surface runoff during precipitation events.

Inorganics were detected in the residue piles at concentrations that warrant further evaluation. Specific inorganics include arsenic, chromium, copper, iron, lead, manganese, nickel, and zinc (ENVIRON 2006a, Table III-3). Traces of organic contaminants were detected in samples from the site; however, organic concentrations generally were below human health risk-based screening levels, with the exception of trichloroethene (TCE) detected in sediment and surface water in a surface drainageway adjacent to the site.

2.2 Potential Transport Mechanisms

Potential transport mechanisms from contaminant sources include the following (ENVIRON 2006a):

- Suspension and transport of particle-associated contaminants in air
- Suspension and transport of particle-associated contaminants in surface water runoff
- Leaching of contaminants from residue piles to underlying soil
- Desorption of contaminants from subsurface soil particles and leaching into underlying groundwater
- Migration of dissolved contaminants in groundwater
- Groundwater-to-surface water transport of contaminants

The potential magnitude of exposure associated with these pathways may differ depending on whether or not the residue piles remain undisturbed. For example, suspension and transportation of soil particle-associated contaminants in air from the residue piles does not appear to be associated with significant releases to offsite locations, either in terms of

airborne concentrations or deposition onto soil. This is the case under current conditions or if the piles are disturbed (that is, graded) in the future; however, disturbance of the residue piles could create exposure pathways to onsite individuals (such as construction workers or trespassers; CH2M HILL 2005). In addition, while airborne deposition does not appear to have resulted in elevated inorganic concentrations in surrounding soil, soil sampling results from around the piles suggests that releases of inorganics may have occurred from surface water runoff (CH2M HILL 2005).

Soil sampling data collected during the RI suggest some leaching of inorganic contaminants may have occurred from the residue piles to underlying soil (ENVIRON 2004a). Concentrations of inorganics also were detected in groundwater downgradient from the residue piles. The RI identified zinc, cadmium, iron, lead, manganese, and thallium as contaminants warranting further evaluation in groundwater due to exceedances of Illinois Water Quality Standards (IWQS). An evaluation of background concentrations of inorganics in groundwater was not included as part of the RI; however, the human health risk assessment (ENVIRON 2004a) notes that groundwater is not used as a drinking water supply for the surrounding Hillsboro community.

2.3 Identification of Key Exposure Pathways, Affected Media, and Receptors

Key exposure pathways, affected media, and associated receptors that might be exposed to risks higher than risk reduction objectives were identified from the risk assessment report (ENVIRON 2004b, 2004c), the addendum to the RI report (ENVIRON 2006a), and the *Review of Nature, Extent of Contaminants, and Risk Assessments* (CH2M HILL 2005) and are summarized in Tables 1 and 2. Table 1 presents a summary of the key affected media, exposure pathways, receptors in terms of current and future land use, contaminants of potential concern, and the effects of changing site conditions. The residential land use scenario is not considered appropriate because of the current deed restriction on the site property. Table 2 presents a breakdown showing where concentrations of contaminants of potential concern in each residue pile may exceed risk reduction objectives, based on different exposure pathways and receptors.

TABLE 1

Summary of Affected Media, Receptors, Pathways and Contaminants of Potential Concern with Risks Higher than Risk Reduction Objectives

Eagle Zinc TM-1

Receptors	Potential Exposure Pathways	Contaminants of Potential Concern	Comments
Affected Media: Residue Piles			
Industrial Land Use	Soil ingestion, dermal contact with soil, inhalation	Lead concentrations higher than 800 mg/kg screening level in all piles MP1-21, NP-15, RCO-10, RRO-12, RR1-3, and RR2-11. Zinc concentrations higher than a hazard quotient of 1 in all piles except MP1-21, NP-15, and RR1-3 Arsenic concentration (200 mg/kg) greater than 1×10^{-4} excess lifetime cancer risk in pile MP1-21	Potential risks may be present if residue piles are disturbed, and site is developed for industrial use in the future.
Construction Workers	Soil ingestion, dermal contact with soil, inhalation	Lead concentrations higher than construction worker screening level in piles MP1-21, RCO-10, RR1-3, and RR2-11.	Potential risks may be present if residue piles are disturbed and site is developed in the future.
Recreational Use	Soil ingestion, dermal contact with soil, inhalation	Lead concentrations higher than recreational use screening level in piles MP1-21, RCO-10, RR1-3, and RR2-11.	Potential risks may be present under current conditions, if trespassers enter these areas.
Affected Media: Onsite Surface Soil (upper 6 inches)			
Industrial Land Use	Soil ingestion, dermal contact with soil, inhalation	Lead concentrations higher than 800 mg/kg screening level in sample A1-3-S1 (near piles RR-1 and RR-2).	Potential risk may be present if this portion of the site is developed for future industrial use.

mg/kg = milligrams per kilogram

TABLE 2

Evaluation of Risks for Each Residue Pile

Eagle Zinc TM-1

Pathway/ Scenario Evaluated	Direct Contact Pathways - Industrial	Direct Contact Pathways - Construction Workers	Direct Contact Pathways - Recreational Use	Airborne Deposition onto Soil from Residue Piles	Potential Runoff onto Soil from Residue Piles
CPH-6	X				
CPH-9	X				
MP1-21	X	X	X		
NP-13					
NP-14					
NP-15	X		X		
NP-16	X				
RCO-10	X	X	X		
RCO-5	X				
RRO-12D	X				
RRO-12	X				
RR1-1	X				X
RR1-2	X				X
RR1-3	X	X	X		
RR1-4	X				
RR2-11	X	X	X		

X - Concentrations of at least one contaminant of concern were higher than risk reduction objectives at this location.

As shown in Tables 1 and 2, most piles contain concentrations of zinc and lead that are higher than risk reduction objectives for industrial land use. A smaller number of piles contain lead concentrations that are higher than lead risk reduction objectives for construction worker and recreational use scenarios. Lead in soil near piles RR1-1 and RR1-2 contain concentrations of lead higher than risk reduction objectives; these results also suggest that surface water runoff has occurred from these two piles.

Modeling performed as part of the supplemental risk evaluation as presented in the *Review of Nature, Extent of Contaminants, and Risk Assessments* (CH2M HILL 2005) indicated that under current conditions, dust emissions from the piles do not appear to produce significant concentrations of inorganics in air or deposition onto surrounding soil. Under future conditions, should the piles be disturbed, graded, or excavated, potential dust emissions

could increase; however, resulting concentrations under future conditions are not likely to result in deposition that would significantly elevate inorganic concentrations in onsite soil. In particular, analytical results from onsite soil suggest that some mechanism other than emissions of dust from the piles is the cause for elevated concentrations in soil surrounding the piles.

3 Ecological Risk Screening Evaluation Summary

The ecological risk screening evaluation (ERSE) was completed as part of the RI and is the first step in assessing risk to the environment. The ERSE assessed the risks to aquatic and terrestrial wildlife that may be exposed to site-related contaminants in soil, surface water, and sediment at and near the site.

Current ecological habitat and biological resources are present in approximately 70 to 75 percent of the onsite areas that are outside the former manufacturing area and residue storage areas. Onsite terrestrial habitat includes woods, old fields, mixed woods, and grasses. Aquatic habitat is present in two primary drainage systems that receive and convey flow from the site. The Eastern Drainage drains the northeastern corner of the site via an undefined channel/marshy area onsite and a more defined natural channel at the eastern boundary of the site. The Eastern Drainage eventually drains into Lake Hillsboro (approximately 0.5 mile from the site), which has relatively abundant aquatic habitat and wildlife. The Eastern Drainage also conveys outflow from two manmade stormwater retention ponds that receive drainage from the former manufacturing area. Onsite Eastern Drainage habitat quality is limited because water does not flow in the drainage year round, but the Eastern Drainage increases in quality offsite closer to the discharge at Lake Hillsboro.

The Western Drainage originates onsite near the former manufacturing area, flows in a southwesterly direction into a stormwater retention pond, and ultimately flows offsite via an outfall to an unnamed drainage. Flow from a stormwater pond merges with flow from another unnamed drainage south of the site and flows westerly until its confluence with an unnamed tributary that ultimately flows northward toward Middle Fork Shoal Creek (approximately 1 mile from the site). Onsite Western Drainage habitat in the onsite stormwater retention pond is perennial and sufficient to support aquatic wildlife, such as small fish, turtles, frogs, and piscivorous wildlife.

3.1 Screening-level Ecological Risk Assessment

A screening-level ecological risk assessment (SLERA) is the second step in the ecological risk assessment process and was performed to conservatively identify risks that the ERSE concluded as needing further evaluation. The assessment endpoints evaluated include the maintenance of diverse and abundant aquatic communities (water-column and benthic), survival and reproductive ability of piscivorous bird and mammal populations, and the survival and reproductive ability of terrestrial birds and mammals. Threatened and endangered species were not considered present onsite.

Exposure point concentrations (EPCs) in surface water and sediment were compared to conservative ecological screening values for aquatic biota (invertebrates and fish) direct

exposure. EPCs in surface water were also compared to conservative screening values for piscivorous wildlife (mink and green heron). Concentrations in soil were entered into food web models to estimate exposure doses that were compared to conservative ecological screening values for terrestrial wildlife (deer mouse, American robin, and red-tailed hawk). The SLERA identified risks to several contaminants versus ecological receptor combinations using conservative assumptions; therefore, further evaluation was required. A Step 3a baseline ecological risk assessment (BERA) was performed to further evaluate the risks identified in the SLERA using more realistic assumptions and less-conservative screening values.

3.2 Baseline Ecological Risk Assessment

The BERA evaluation of direct toxicity to aquatic biota from exposure to surface water identified elevated (greater than 1) hazard quotients (HQs), based on a comparison to less-conservative screening values for aluminum, cadmium, copper, lead, mercury, and zinc in the Eastern and Western drainages. The BERA is the third step in the ecological risk assessment process. Elevated HQs may predict adverse impacts to aquatic wildlife. A habitat quality survey was conducted by the Parties at each sampling location to evaluate the potential for adverse effects from aluminum, cadmium, copper, lead, mercury, and zinc. Both the pond and the portion of the Eastern Drainage closest to Lake Hillsboro were identified as having higher quality habitat and appeared to support a variety of aquatic species, despite having elevated HQs. The other sample locations visited (both onsite and offsite) also had elevated HQs, but had poor habitat quality because of high sedimentation or inadequate substrate and flow regime. Based on the spatial distribution of contaminants and the available habitat quality, it was concluded that adverse impacts are not likely occurring in onsite or offsite surface water bodies under current conditions.

The evaluation of piscivorous wildlife (mink and green heron) exposed through modeled water and dietary intake concluded that adverse impacts to piscivorous wildlife are not likely to be associated with site-related contaminants detected in the Eastern Drainage or the offsite Western Drainage. Although some elevated HQs for piscivorous wildlife were observed (cadmium, selenium, and zinc), the HQs were considered along with lines of evidence regarding the spatial distribution of contaminants, the available habitat quality, and observations of aquatic wildlife. Based on these multiple lines of evidence, it was concluded that adverse impacts to piscivorous wildlife are not likely occurring under current conditions.

The evaluation of terrestrial wildlife (deer mouse, American robin, and red-tailed hawk) exposed via the food web concluded that adverse effects are not likely occurring under current conditions. Although some elevated (greater than 1) HQs were observed for cadmium and zinc, an evaluation of the data suggests the ecological risks as being driven by soil sample concentrations collected below residue material, which would most likely be inaccessible to terrestrial food webs.

Future conditions were evaluated in the addendum to the RI (ENVIRON 2005) and in the *Review of Nature, Extent of Contaminants, and Risk Assessments* (CH2M HILL 2005). Based on predicted concentrations from windborne transport and distribution from the residue piles, adverse impacts to receptors evaluated in the ERSE were not considered likely. If fine

particulates were distributed from disturbed residue piles to the drainages and terrestrial portions of the site, and using conservative and realistic assumptions from the Step 3a BERA, high risks to terrestrial wildlife (HQs greater than 10) from zinc were predicted, with low to moderate risks (HQs greater than 1) from lead and selenium. In sediment, the model suggests high risks due to cadmium, cobalt, copper, lead, nickel, silver, and zinc concentrations, and low to moderate risks due to arsenic, chromium, iron, manganese, and mercury concentrations. In surface water, the model suggests high risks due to aluminum, cadmium, copper, iron, nickel, and zinc concentrations, and low to moderate risks due to arsenic and manganese concentrations.

Future impacts to aquatic habitat are dependent on the quality of the habitat. Although elevated concentrations of inorganics in surface water and sediment are present in the drainages, poor habitat quality limits ecological exposure. Poor habitat quality in the future will also limit ecological exposure despite elevated surface water and sediment concentrations. Habitat improvements to these areas will increase ecological exposure and, therefore, increase ecological risk.

In addition to the RI addendum (ENVIRON 2005) and *Review of Nature, Extent of Contaminants, and Risk Assessments* (CH2M HILL 2005) regarding risks under future conditions, special consideration was given to the dead catalpa trees observed onsite in the Eastern Drainage. The possibility of degradation from inorganic exposure was considered unlikely because of low soil concentrations in the immediate area. Dead trees were collocated with hydric soil atypical of the species' preferred habitat. The recent succession to *Salix* species (that is, willows, which are a hydrophilic species) was noted in areas with inundation, and catalpa's natural resistance to degradation, which allow tree remnants to accumulate, giving the appearance of widespread mortality. Frequent overflows and periods of saturation are common because the drainage is largely undefined in this area. These lines of evidence suggest that contaminant exposure is an unlikely reason for the catalpa tree mortality.

Based on the conclusions of the RI, RI addendum, and the *Review of Nature, Extent of Contaminants, and Risk Assessments*, additional monitoring of aquatic and terrestrial habitat may be needed to evaluate future conditions at the site. This monitoring, as part of the remedy, will be necessary to assess future habitat. Adverse impacts to ecological receptors may occur if aquatic habitat quality improves in areas with existing levels of aluminum, cadmium, copper, lead, mercury, and zinc. Adverse impacts to aquatic and terrestrial ecological receptors from several contaminants may also occur if disturbance to the residue piles results in the dispersal of fine-grained particulates to these habitats.

4 Feasibility Study Updates

As stated above, the steps of the FS process noted below were updated due to the revised risk assessments and are presented in subsequent sections:

- ARAR identification
- RAO development
- PRGs
- Remedial alternative development

4.1 Summary of Applicable or Relevant and Appropriate Requirements

Remedial actions must be protective of public health and the environment and address risks identified in the human health and ecological risk assessment. Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that primary consideration be given to remedial alternatives that attain or exceed ARARs. The purpose of this requirement is to make CERCLA response actions consistent with other pertinent federal and state environmental requirements, as well as to adequately protect public health and the environment.

ARARs are grouped into three types: contaminant-specific, location-specific, and action-specific. Included in Appendix A are the contaminant-specific, action-specific, and location-specific ARARs for Eagle Zinc. The most important ARARs are discussed below. To-be-considered (TBC) factors are nonpromulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. In many circumstances, however, such factors will be considered along with ARARs in determining the level of cleanup required to protect human health and the environment. Potential ARARs are listed in Appendix A along with an analysis of the ARAR status relative to remediation at the site.

4.2 Contaminant-specific ARARs

Contaminant-specific ARARs include laws and requirements that establish health- or risk-based numerical values or methodologies for environmental contaminant concentrations or discharge. The contaminant-specific ARARs for the site can be classified into two categories: (1) residual concentrations of compounds that can remain at the site without presenting a threat to human health and the environment; and (2) land disposal restriction (LDR) concentrations that must be achieved if the contaminated media that either is a characteristic hazardous waste or contains a listed hazardous waste is excavated and later land disposed offsite.

4.2.1 Residual Concentrations

There are no contaminant-specific federal or Illinois ARARs for soil. TBCs for residual soil concentrations include the USEPA Region 9 PRGs and Illinois Environmental Protection Agency (IEPA) Tiered Approach to Corrective Action Objectives (TACO) remediation objectives. IEPA TACO remediation objectives are not ARARs because a facility may choose not to use them per 35 Illinois Administrative Code (IAC) 742.105 (a) and (b).

For groundwater, Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs) and the IWQS (IAC Part 620) for Class I aquifers are possible ARARs depending on aquifer classification. Groundwater greater than 10 feet below ground surface (bgs) may be considered a Class I potable resource groundwater. Groundwater within 10 feet of the surface is a Class II groundwater, and IWQS are higher for these. Much of the shallow contaminated groundwater migrating along the interface of the residue and the original land surface is likely a Class II groundwater. IEPA TACO remediation objectives are not ARARs but are similar to the IWQS.

For surface water, the IWQS (IAC Part 320) are ARARs. The federal water Pollution Control Act as amended by the Clean Water Act of 1977 also provides contaminant-specific water quality criteria for surface water, although these are TBC values rather than ARARs.

4.2.2 Land Disposal Restriction Concentrations

The Resource Conservation and Recovery Act (RCRA) LDRs would apply to remedial actions performed at the site that involve waste (such as residue piles or contaminated soil) generation (that is, waste is excavated and taken offsite), contains a RCRA hazardous waste, or is itself a characteristic hazardous waste. Listed hazardous wastes are not known to have been disposed at Eagle Zinc. As a result, excavated piles or soil would not be required to be managed as listed hazardous wastes. If the piles or soil are excavated and removed from the area of contamination (that is, "generated"), the residue piles or soil may be a characteristic hazardous waste, such as a D008 toxicity characteristic hazardous waste for lead. The hazardous waste characterization is determined by analyzing residue and/or soil samples for lead using the toxicity characteristic leaching procedure (TCLP). If the TCLP leachate is greater than 5 milligrams per liter (mg/L), then the waste generated will be considered a hazardous waste and will be managed as such.

Three of the 15 residue piles tested for characteristic hazardous waste exceeded the TCLP limit of 5 mg/L for lead, making these three residue piles characteristic hazardous waste if they are removed and transported offsite. Residue that exceeds the TCLP lead limit must be managed as a hazardous waste and must meet the LDR treatment standards for D008 characteristic hazardous waste (40 Code of Federal Regulations [CFR] 268.40). The LDR is 0.75 mg/L in the TCLP lead extract, meaning that the treated characteristic hazardous waste residue can be disposed of in a Subtitle D landfill because it would no longer exhibit characteristics of a hazardous waste.

Soil that is a characteristic hazardous waste for lead must meet the LDRs for contaminated soil (40 CFR 268.49) if taken offsite. The treatment standard for contaminated soil is the higher of a 90 percent reduction in constituent concentrations or 10 times the Universal Treatment Standards (UTS). The UTS for D008 characteristic hazardous waste is 0.75 mg/L in the TCLP extract. As a result, soil that is a characteristic hazardous waste for lead must meet the higher of a 90 percent reduction in the TCLP extract concentration or 7.5 mg/L. If the treated characteristic hazardous waste soil remains above 5 mg/L, land disposal would require a RCRA Subtitle C hazardous waste landfill.

4.3 Action-specific ARARs

Action-specific ARARs regulate the specific type of action or technology under consideration, or the management of regulated materials. The most important action-specific ARARs that may affect the RAOs and the development of remedial action alternatives are CERCLA and RCRA regulations.

4.3.1 Comprehensive Environmental Response, Compensation, and Liability Act

CERCLA requires the selected remedy to meet the substantive requirements of environmental rules and regulations that are ARARs.

4.3.2 Resource Conservation and Recovery Act

RCRA regulations governing the identification, management, treatment, storage, and disposal of solid and hazardous waste would be ARARs for alternatives that generate waste that would be moved to a location outside the area of contamination. Such alternatives could include excavation of residue piles or soil. Requirements include waste accumulation, record keeping, container storage, disposal, manifesting, transportation, and disposal.

As discussed above, portions of the residue piles at Eagle Zinc may be characteristic hazardous waste. If the soil is characteristic hazardous waste and transported offsite, RCRA LDRs would apply and treatment would be required in accordance with RCRA prior to disposal. The most likely LDR that would have to be met is treatment to 0.75 mg/L lead in TCLP extract. As discussed, this treatment would render the waste nonhazardous and then be disposed of in a RCRA Subtitle D landfill. Nonhazardous waste soil would be disposed of in accordance with Illinois solid waste disposal requirements.

4.4 Location-specific ARARs

Location-specific ARARs are requirements that relate to the geographical position of the site. State and federal laws and regulations that apply to the protection of wetlands, construction in floodplains, and protection of endangered species in streams or rivers are examples of location-specific ARARs. The most important location-specific ARARs for Eagle Zinc are the following:

- Fish and Wildlife Coordination Act. This was enacted to protect fish and wildlife when actions result in the control or structural modification of a natural stream or body of water. The statute requires that any action take into consideration the effect that water-related projects would have on fish and wildlife, and then take action to prevent loss or damage to these resources.
- Executive Order 11990 (Protection of Wetlands), 50 CFR § 6 Appendix A is a TBC. EO 11990 requires that actions at the site be conducted in ways that minimize the destruction, loss, or degradation of wetlands. Small wetland areas are adjacent to the onsite stormwater retention pond.

5 Remedial Action Objectives

RAOs are developed as site-specific objectives for the purpose of protecting human health and the environment. Once RAOs are designated, they serve as a basis for the development of remedial action alternatives necessary to meet the remediation goals. The RAOs for the site are based on the human health and ecological risk assessment findings summarized above as well as site-specific ARARs. PRGs are site-specific, quantitative goals that define the extent of cleanup required to achieve the RAOs. These PRGs were developed and used in the FS, and they will be finalized in the Record of Decision (ROD) for Eagle Zinc. In this section, RAOs were developed for the media of concern that either have unacceptable risks to human health and the environment or have contaminant concentrations exceeding ARARs. The media of concern for Eagle Zinc include residue piles, soil, groundwater, surface water, and sediment.

5.1 Residue Piles

The RAOs for the residue piles are as follows:

- Prevention of industrial, construction worker, or recreational human exposure, through contact, ingestion, or inhalation to arsenic-, zinc-, and lead-contaminated soil that presents an excess lifetime cancer risk (ELCR) greater than 1×10^{-4} to 1×10^{-6} , noncancer hazard index (HI) greater than 1.
- Prevention of residue pile erosion with resulting transport of arsenic, zinc, or lead concentrations to surrounding soil or surface water bodies.
- Minimize leaching of lead, cadmium, manganese, and zinc from the residue piles to groundwater so that SDWA MCLs and IWQS Class I groundwater standards are not exceeded if determined to be a Class I aquifer.
- Minimize release of aluminum, cadmium, copper, iron, nickel, and zinc from disturbed residue piles to surface water and cadmium, cobalt, copper, lead, nickel, silver, and zinc from disturbed residue piles to sediment to prevent toxicity to aquatic biota under future conditions of improved habitat in the Eastern and Western drainages, per the ecological risk assessment.

5.2 Soil

The soil media includes residue and soil located onsite in areas between the 15 residue piles. The RAO for soil is the prevention of industrial human exposure, through contact, ingestion, or inhalation to lead-contaminated soil to levels presented in the USEPA lead policy.

5.3 Groundwater

Groundwater is not currently used and is unlikely to be used in the future, so ingestion of groundwater was not evaluated as an exposure pathway. However, since the groundwater may be useable, restoration to SDWA MCLs and IWQS for Class I groundwater is a possible RAO per the NCP and Title 35 IAC Part 620. The RAOs for groundwater are as follows:

- Prevention of ingestion of groundwater with concentrations of lead, cadmium, manganese, and zinc exceeding SDWA MCLs or IWQS for Class I groundwater.
- Restoration of groundwater to SDWA MCLs or IWQS for Class I groundwater standards for lead, cadmium, manganese, and zinc in a reasonable time frame.
- Minimize discharge of cadmium, iron, and zinc from groundwater to surface water at concentrations that result in surface water exceeding IWQS per Title 35 IAC Part 302.

According to the RI, additional inorganics exceeded SDWA MCLs or IWQS for Class I groundwater for total inorganics analysis. It is not clear if the total inorganics results were representative of groundwater or biased high as a result of suspended solids entrained in the samples. These additional inorganics are arsenic, beryllium, chromium, iron, nickel, sulfate, thallium, and vanadium. Future groundwater monitoring should include these as potentially present in groundwater above MCLs, in which case, an additional RAO may be developed to address the additional inorganic concentrations in groundwater.

5.4 Surface Water

As discussed in the ecological risk assessment summary above, the most likely scenario that may cause adverse impacts to ecological receptors is the disturbance to the residue piles resulting in the dispersal of fine-grained particulates to these habitats. Adverse impacts may also occur if aquatic habitat quality improves over the longer term in areas with existing levels of aluminum, arsenic, cadmium, copper, lead, manganese, mercury, nickel, and zinc.

Concentrations of inorganics in surface water currently exceed IWQS for cadmium, iron, and zinc. The RAOs for surface water are as follows:

- Assuming aquatic habitat improves in the future, minimize adverse impacts to aquatic receptors as a result of the discharge of aluminum, arsenic, cadmium, copper, lead, manganese, mercury, nickel, and zinc.
- Restoration of surface water to IWQS for cadmium, iron, and zinc in a reasonable time frame.

5.5 Sediment

Adverse impacts to ecological receptors may occur if aquatic habitat quality improves in areas with existing levels of cadmium, cobalt, copper, lead, nickel, silver, and zinc in sediment. In addition, adverse impacts may occur from zinc if disturbance to the residue piles results in the dispersal of fine-grained particulates to the sediment of these habitats. The RAO for sediment is as follows:

- Assuming aquatic habitat improves in the future, minimize adverse impacts to aquatic receptors as a result of cadmium, cobalt, copper, lead, nickel, silver, and zinc in sediment as presented in the ecological risk assessment.

6 Preliminary Remediation Goals

To meet the RAOs, PRGs were developed to define the extent of contaminated media requiring remedial action. This section presents the PRGs and defines the volumes of affected media exceeding the PRGs that will be addressed in the FS process. In general, PRGs establish media-specific concentrations of contaminants of concern (COCs) that will pose no unacceptable risk to human health and the environment. COCs are the list of contaminants that result in unacceptable risk based on the results of the risk assessment. In some cases, such as for the groundwater media, contaminants that exceed ARARs may be added to the COC list even though they were not identified in the risk assessment as posing unacceptable risk. The PRGs were developed considering the following:

- Risk-based concentration levels corresponding to an ELCR between 1×10^{-4} and 1×10^{-6} , a chronic health risk defined by an HI of 1, and/or a significant ecological risk.
- Contaminant-specific ARARs and TBCs possibly including federal MCLs for groundwater, IWQS for Class I groundwater (possibly), and IEPA TACO Tier 1 remedial objectives for soil and groundwater. The TACO Tier 1 remediation objectives are TBCs

and are set at HI equals 1 and ELCR values at 1×10^{-6} . The ELCR values could be modified upward to represent the values corresponding to a cumulative risk of 1×10^{-4} .

- Background concentrations of specific contaminants.

A summary of the PRGs for residue piles and soil, groundwater, surface water, and sediment exposure pathways at Eagle Zinc are included in Tables 3, 4, 5, and 6, respectively.

Residue pile and soil COCs for human health direct contact and ingestion include arsenic, lead, and zinc. Selenium is also a soil COC for ecological receptors. Cadmium and manganese are added to the soil COC list for the leaching to groundwater pathway because these contaminants in groundwater exceed groundwater PRGs and are present in soil at concentrations that could result in leaching to groundwater.

Illinois TACO regulations present soil remediation objectives for inorganics in terms of either total concentrations in soil as a function of soil pH or in terms of a synthetic precipitation leaching procedure (SPLP) concentration in the test extract water. The site soil pH ranged from 4.3 to 7.9, resulting in a wide range of values for cadmium and zinc. The SPLP test is a more appropriate test because of this wide range of soil pH observed because it gives a direct and site-specific indication of leachability. The residue piles were sampled and analyzed for SPLP cadmium and lead during the RI, and these results indicate three of the residue pile samples exceed the SPLP PRG.

Residue piles and soil PRGs for multiple land uses and exposure scenarios are presented in Tables 3, 4, 5, and 6. A deed restriction is in place limiting the future use of the property to industrial, and the site is zoned industrial. The industrial land use is considered the most likely foreseeable future land use. The industrial PRGs along with the construction worker PRGs will be used to define areas requiring remediation. The industrial soil direct contact PRGs apply to the upper 2 feet of residue and soil, per USEPA Risk Assessment Guidance. The construction worker PRGs also apply to residue piles and soil to depths typically encountered during construction (assumed to be 10 feet). Arsenic PRGs default to the Illinois background concentration because the industrial PRG of 1.4 mg/kg is less than background (IEPA TACO).

Groundwater PRGs may include the federal SDWA MCLs depending on aquifer classification. The PRGs for manganese and zinc are based on the SDWA secondary standards based on aesthetic criteria rather than human health. Also included as groundwater PRGs are the IWQS and criteria for surface water because groundwater discharges to surface water onsite and is likely a cause of surface water concentrations exceeding PRGs.

Surface water PRGs include the National Ambient Water Quality Criteria and IWQS for general use as well as secondary contact and aquatic life. Where upstream background sample results exceed the criteria or standards, they are used as the PRG in cases where the upstream concentrations are greater than the standards. Sediment PRGs are based on probable effects levels (PELs), effects range medians (ERMs), severe effects levels (SELs), and toxic effects thresholds (TETs) as presented in MacDonald et al. (2000).

TABLE 3
Preliminary Remediation Goals, Residue Piles, Surface and Shallow Soils (mg/kg)
Eagle Zinc TM-1

Soil COC	USEPA Region 9 TBCs ELCR ^a (mg/kg)					TACO Tier 1	Illinois TACO TBCs ^b (mg/kg)		State of Illinois Background Outside Metro statistical area	Ecological PRGs for Terrestrial Wildlife ^c (mg/kg) (PRGs for potential future disturbed piles only)
	1.00E-06	1.00E-05	1.00E-04	HQ = 1	Lead		TACO Protection of Groundwater- Total	TACO Protection of Groundwater- SPLP (µg/L)		
Onsite Industrial Land Use										
Industrial										
Arsenic	1.4	14	140	230	NC	11.3	NC ^d	NC ^d	11.3	NC
Cadmium ^e	NC	NC	NC	NC	800	NC	1 - 430	5 µg/L	NC	NC
Lead					NC	400	-	7.5 µg/L	20.9	40.5
Manganese ^a	NC	NC	NC	NC	NC	NC	-	150 µg/L	NC	NC
Selenium	NC	NC	NC	NC	NC	NC	NC ^d	NC ^d	NC	0.21
Zinc				330,000		610,000	1,000 - 53,000	5,000 µg/L	60.2	8.5
Construction										
Arsenic	99	990	9900	73	800	61			11.3	
Lead						400			20.9	
Zinc				88,000		61,000			60.2	
Offsite Residential Land Use										
Adult Residential										
Arsenic	0.88	8.8	88	170	400	750			11.3	
Lead						400			20.9	
Zinc				210,000		23,000			60.2	
Child-Residential										
Arsenic	0.5	5	50	19	400	750			11.3	
Lead						400			20.9	
Zinc				23,000		23,000			60.2	
Adult-Recreational										
Lead					400	400			20.9	
Arsenic	5.1	51	510	790		750			11.3	
Zinc				1,000,000		23,000			60.2	
Child-Recreational										
Lead					400	400			20.9	
Arsenic	2.4	24	240	91		750			11.3	
Zinc				110,000		23,000			60.2	

Bold values are used as lowest applicable PRG- see text for further explanation. NC = not a COC

^a USEPA Region 9 Preliminary Remedial Goals Table, Direct Contact Exposure Pathway, October 2004; ELCR = Estimated Lifetime Cancer Risk; HQ = Hazard Quotient

^b TACO = Tiered Approach to Corrective Action Objectives. Values for TACO Tier 1 Industrial/Construction Worker: Section 742, Table B; Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties: Values for TACO Tier 1 Residential: Section 742, Table A; Tier 1 Soil Remediation Objectives for Residential Properties: State of Illinois Background: Section 742, TABLE G; Concentrations of Inorganic Chemicals in Background Soils.

TACO protection of groundwater values are either based on total concentration in soil or the leachate concentration in an SPLP test. For values based on total concentration, the inorganics are pH dependent. Values presented are based on the site-specific soil pH range of 4.3 to 7.9. They apply to all land use categories.

^c Ecological PRGs based on Effroymsen et al. 1997 for the lowest plant, wildlife and soil invertebrate benchmarks. They apply to all land use categories.

^d Contaminant is not a COC for groundwater so protection of groundwater values do not apply.

^e Contaminant is only a soil COC relative to the potential to leach to groundwater.

TABLE 4**Preliminary Remediation Goals**

Groundwater (µg/L)

Eagle Zinc TM-1

Contaminant	Drinking Water Resource ^a				Protection of Surface Water ^b		
	MCL	NSDWR	IAC Water Supply	Illinois Groundwater Quality Standards for Class I Potable Resource Groundwater	Illinois TACO	NAWQC	IAC General Water Quality Standards IAC Secondary Contact and Aquatic Life
Groundwater COCs							
Lead	15		50	7.5	7.5	NC	NC
Cadmium	5		10	5	5	0.59 ^c	2.61 ^d
Manganese		50	150	150	150	120	1,000
Zinc		5,000		5,000	5,000	344 ^e	62.8 ^d
COCs for Groundwater Discharge to Surface Water							
Aluminum	NC	NC	NC	NC	NC	87	-
Arsenic	NC	NC	NC	NC	NC	150	1,000
Copper	NC	NC	NC	NC	NC	26.3 ^c	33.4 ⁿ
Iron	NC	NC	NC	NC	NC	1,000	1,000
Nickel	NC	NC	NC	NC	NC	151.2 ^c	2,000
							1,000

Bold values are used as lowest applicable PRG- see text for further explanation.

NC= not a COC based on risk assessment and does not exceed ARARs.

^a PRGS for restoration of groundwater for use as a water supply resource. MCLs from <http://www.epa.gov/safewater/mcl.html#mcls>

NSDWR = National Secondary Drinking Water Regulations

IAC Water Supply: Public and Food Processing Water Supply Standards (Illinois Section 302.304)

Illinois Groundwater Quality Standards for Class I Potable Resource Groundwater; IAC 620.410.

TACO = Illinois Tiered Approach to Corrective Action Objectives (35 Illinois Administrative Code, Part 742)

TACO GW = Section 742, Appendix B, Table E, Class 1, Groundwater Remediation Objectives for the Groundwater Component of the Groundwater Ingestion Route

ⁿ Protection of surface water PRGs are intended to protect surface water from discharge of groundwater containing COCs > surface water PRGs. The surface water PRGs are the NAWQC (National Ambient Water Quality Criteria, USEPA 2006) for protection of aquatic life, the Illinois General Use Water Quality Standards (IAC Section 302.208) and Illinois (IAC section 302.407) standards for secondary contact and indigenous aquatic life.^c Based on mean hardness of 353 mg/L (TABLE VII-1b; Environ, 2004) and the following calculations from USEPA, 2006:Cadmium = $\text{EXP}(0.7409 \cdot (\text{LN}(\text{hardness})) - 4.719) \cdot (1.101672 \cdot (\text{LN}(\text{hardness}))^{0.041838})$ Copper = $\text{EXP}(0.819 \cdot (\text{LN}(\text{hardness})) - 0.6848) \cdot 0.86$ Nickel = $\text{EXP}(0.846 \cdot (\text{LN}(\text{hardness})) + 0.0584) \cdot 0.997$ Zinc = $\text{EXP}(0.8473 \cdot (\text{LN}(\text{hardness})) + 0.884) \cdot 0.986$ ^d Based on mean hardness of 353 mg/L (TABLE VII-1b; Environ, 2004) and the following calculations from IAC 302.208:Cadmium = $\text{EXP}(-3.49 + 0.7852 \cdot (\text{LN}(\text{hardness}))) \cdot (1.101672 \cdot (\text{LN}(\text{hardness}))^{0.041838})$ Lead = $\text{EXP}(-2.863 + 1.273 \cdot (\text{LN}(\text{hardness}))) \cdot (1.46203 \cdot (\text{LN}(\text{hardness}))^{0.145712})$ Copper = $\text{EXP}(-1.465 + 0.8545 \cdot (\text{LN}(\text{hardness}))) \cdot 0.96$ Nickel = $\text{EXP}(-2.286 + 0.846 \cdot (\text{LN}(\text{hardness}))) \cdot 0.997$ Zinc = $\text{EXP}(-0.8165 + 0.8473 \cdot (\text{LN}(\text{hardness}))) \cdot 0.986$

TABLE 5
Preliminary Remediation Goals
Surface Water (µg/L)
Eagle Zinc TM-1

Surface Water COC	Surface Water ^a			
	Background (SW-WD-11)	NAWQC	IAC General Use Water Quality Standards	IAC Secondary Contact and Aquatic Life
Aluminum	1,100	87	-	-
Arsenic	2.3 J	150	190	1,000
Cadmium	0.19 J	0.59 ^c	2.61 ^d	150
Copper	3.7 J	26.3 ^c	33.4 ^d	1,000
Iron	1,400	1,000	1,000	2,000
Manganese	250	120 ^b	1,000	1,000
Nickel	2.9 J	151.2 ^c	14.5 ^d	1,000
Zinc	72 U	344 ^c	62.8 ^d	1,000

Bold values are used as lowest applicable PRG- see text for further explanation.

NC= not a COC

^e The surface water PRGS are the NAWQC (National Ambient Water Quality Criteria, USEPA 2006) for protection of aquatic life, the Illinois General Use Water Quality Standards (IAC Section 302.208) and Illinois (IAC section 302.407) standards for secondary contact and indigenous aquatic life.

^t Secondary chronic value (Suter and Tsao, 1996).

^c Based on mean hardness of 353 mg/L (TABLE VII-1b; Environ, 2004) and the following calculations from USEPA, 2006:

$$\text{Cadmium} = \text{EXP}(0.7409 * (\text{LN}(\text{hardness})) - 4.719) * (1.101672 - (\text{LN}(\text{hardness}) * (0.041838)))$$

$$\text{Copper} = (\text{EXP}(0.819 * (\text{LN}(\text{hardness})) + 0.6848)) * 0.86$$

$$\text{Nickel} = \text{EXP}(0.846 * (\text{LN}(\text{hardness})) + 0.0584) * 0.997$$

$$\text{Zinc} = \text{EXP}(0.8473 * (\text{LN}(\text{hardness})) + 0.884) * 0.986$$

^d Based on mean hardness of 353 mg/L (TABLE VII-1b; Environ, 2004) and the following calculations from IAC 302.208:

$$\text{Cadmium} = \text{EXP}(-3.49 + 0.7852 * (\text{LN}(\text{hardness}))) * (1.101672 - (\text{LN}(\text{hardness}) * (0.041838)))$$

$$\text{Lead} = \text{EXP}(-2.863 + 1.273 * (\text{LN}(\text{hardness}))) * (1.46203 - (\text{LN}(\text{hardness}) * (0.145712)))$$

$$\text{Copper} = (\text{EXP}(-1.465 + 0.8545 * (\text{LN}(\text{hardness})))) * 0.96$$

$$\text{Nickel} = \text{EXP}(-2.286 + 0.846 * (\text{LN}(\text{hardness}))) * 0.997$$

$$\text{Zinc} = \text{EXP}(-0.8165 + 0.8473 * (\text{LN}(\text{hardness}))) * 0.986$$

TABLE 6
Preliminary Remedial Goals
Sediment (mg/kg)
Eagle Zinc TM-1

Sediment COC	Background (SD-WD-05)	PRG	Basis	Comment	Source
Arsenic	5.4 J	33	PEC ^a	geometric mean of benchmarks listed below	MacDonald et al. 2000
Cadmium	0.48	4.98	PEC	geometric mean of benchmarks listed below	MacDonald et al. 2000
Chromium	7.3 J	111	PEC	geometric mean of benchmarks listed below	MacDonald et al. 2000
Cobalt	3.5	none	--	--	--
Copper	9.6	149	PEC	geometric mean of benchmarks listed below	MacDonald et al. 2000
Iron	11,000	none	--	--	--
Lead	28	128	PEC	geometric mean of benchmarks listed below	MacDonald et al. 2000
Manganese	480	none	--	--	--
Mercury	0.0093	1.06	PEC	geometric mean of benchmarks listed below	MacDonald et al. 2000
Nickel	6.5	48.6	PEC	geometric mean of benchmarks listed below	MacDonald et al. 2000
Silver	0.1 U	1.8	PEL		MacDonald 1994
Zinc	310 J	459	PEC	geometric mean of benchmarks listed below	MacDonald et al. 2000

Bold values are used as lowest applicable PRG- see text for further explanation.

^a Include PELs (Smith et al. 1996; US EPA 1996a), ERMIs (Long and Morgan 1991), SELs (Persaud et al. 1993) and TETs (EC and MENVIQ 1992).

7 Contaminated Media Exceeding PRGs

The areas and volumes of media that exceed the PRGs were developed by comparing RI results with the lowest applicable PRG. Below is a discussion of the media exceeding the PRGs.

7.1 Residue Piles

Thirteen of the 15 residue piles exceed soil direct contact PRGs, as shown in Figure 1. Arsenic, lead, and zinc are the COCs most often exceeded based on the results presented in Table III-3 of the Addendum to the RI Report (ENVIRON 2005). Three residue piles (RR1-3, NP-14, and MP1-21) exceeded the protection of groundwater SPLP limit PRGs for cadmium or lead (see Table IV-9 of the TM Remedial Investigation Phase 1: Source Characterization; ENVIRON 2003). Note that SPLP results were not available for zinc. A summary of the estimated volume of each pile exceeding PRGs is presented in Table 7. Volume estimates are based on those presented in Table III-3 of the Addendum to the RI Report (ENVIRON 2005).

TABLE 7
Residue Piles Exceeding PRGs
Eagle Zinc TM-1

Residue Pile	Direct Contact PRG Exceeded?	Protection of Groundwater PRG Exceeded? ^a	Volume Estimate (cy)
C ^{PH} -6	X		800
C ^{PH} -9	X		800
MP1-21	X	X	500
NP-13			NA
NP-14		X	500
NP-15	X		1,100
NP-16	X		5,000
RCO-10	X		4,500
RCO-5	X		3,200
RRO-12	X		11,600
RR1-1	X		1,400
RR1-2	X		2,300
RR1-3	X	X	1,100
RR1-4	X		2,700
RR2-11	X		8,000
Total Volume			43,500

^a Groundwater PRGs are dependent upon aquifer classification.

7.2 Onsite Soil

Six of 35 onsite surface soil samples exceeded direct contact PRGs. Five of these samples, however, only marginally exceeded the arsenic background PRG of 11.3 milligrams per kilogram (mg/kg; values ranged from 12 to 13 mg/kg). As a result, these five areas are considered similar to background and are not included in the area exceeding PRGs. The remaining sample that exceeded direct contact PRGs was sample A1-3-S1. The sample exceeded the arsenic and lead industrial PRG. The area represented by this sample is about 30,000 square feet (ft²). The depth of the exceedance is 0.5 foot, since the sample interval from 0.5 to 1 foot did not exceed the PRGs. The volume of soil represented by this sample is 560 cubic yards (yd³).

Soil was not analyzed for SPLP, so a direct comparison of soil results to the SPLP-based PRGs for protection of groundwater is not possible. Based on the SPLP results for the residue piles, though, it is expected that a relatively minor fraction of the soil would exceed cadmium and lead PRGs for protection of groundwater. Zinc SPLP results are not available for the residue piles. Comparison of soil cadmium and zinc concentrations to the lower end of the protection of groundwater PRGs based on the lowest soil pH (cadmium PRG of 1 mg/kg and zinc PRG of 1,000 mg/kg) results in most soil samples exceeding the PRGs. An alternate method of determining the area of soil and residue leaching contaminants to groundwater is to assume that the area is no larger than the area of groundwater with concentrations of cadmium and zinc in excess of the PRG. Cadmium and zinc groundwater plumes exceeding groundwater PRGs in the southwest portion of the site encompass an area of about 20 acres. Given the current data, it is not possible to positively identify the area of soil and residue leaching to groundwater at concentrations resulting in groundwater PRG exceedances, but the area is expected to be less than 20 acres in the southwest portion of the site. This area is outlined in green on Figure 2.

A similar evaluation was done to identify the area of soil and residue that may be contributing to the exceedance of surface water PRGs. Zinc was the COC in surface water that had the greatest and most extensive exceedance of the surface water PRGs. Zinc is present in groundwater at concentrations greater than 1,000 micrograms per liter (µg/L; more than 10 times the surface water PRG of 63 µg/L) in a 20-acre area in the southwest portion of the site, the same area discussed above where zinc exceeds the groundwater PRG. In addition, a 13-acre area around MW2 and MW4 in the north-central portion of the site has groundwater greatly exceeding the zinc in surface water PRG.

7.3 Offsite Soil

The residential land use scenario is applicable to areas offsite. In 1993, IEPA collected 15 offsite soil samples. Three of the 15 offsite surface soil samples exceeded residential direct contact PRGs. All three samples, however, only marginally exceeded the arsenic background PRG of 11.3 mg/kg (the three values ranged from 11.9 to 13.6 mg/kg).

In April 2005, IEPA collected 20 offsite soil samples. Six of the 20 offsite surface soil samples exceeded residential direct contact PRGs (Table 8). Arsenic and lead exceeded residential direct contact PRGs in five of the six samples, and arsenic, lead, and zinc had exceedances in one of the six. In general, the exceedances were not great. It is unclear whether the sample

exceedances were related to offsite transport of site COCs or were related to other urban sources.

Offsite soil is not considered a media requiring remediation because of the sporadic and relatively low exceedances of PRGs, as well as the uncertainty as to whether they are related to the site.

TABLE 8
Offsite Soil Samples Exceeding PRGs
Eagle Zinc TM-1

Sample Location	Arsenic (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)
Residential PRG	11.3	400	23,000
X105	9.2	408	19,200
X115	11.6	469	22,400
X119	19.4	258	5,960
X123	15.8	574	2,470
X112	16.3	417	4,080
X113	14.9	401	70,600

Bold represents contaminant exceedances.

7.4 Groundwater

The area exceeding groundwater PRGs as a drinking water resource is presented in Figure 2. As stated, aquifer classification has not been determined. The area presenting a human health risk from hypothetical future ingestion is represented by the cadmium plume and is confined to an area of about 20 acres in the southwest portion of the site. A larger area (about 90 acres) includes the area where manganese exceeds the secondary aesthetic PRG for taste.

The area of groundwater that exceeds the surface water PRGs covers nearly the entire site. It is the area of the manganese plume plus areas to the east below the former process buildings (the manganese plume plus the area represented by MW1, MW2 and G101). This area may potentially contribute to the surface water PRG exceedances as groundwater discharges to surface water of the Eastern and Western Drainage areas.

At the site, groundwater is present in relatively impermeable clay, silty clay, and sandy clay that is present below the residue to a depth of about 15 feet bgs. Groundwater may also be present in a relatively thin zone within the residue above the silty clay. The residue is expected to be much more permeable than the underlying soil. Rainfall would be expected to rapidly infiltrate, with minimal evapotranspiration losses, through the residue and flow laterally on top of the silty clay and discharge to the Eastern and Western drainages with only a relatively small proportion entering the silty clay.

7.5 Surface Water

Surface water sample locations other than the background location SW-WD-11 exceeded at least one PRG. Zinc had the most and greatest exceedances of PRGs, followed by manganese and nickel (see Table IV-7 of the Remedial Investigation Report; ENVIRON 2005). Iron and nickel also exceeded PRGs at multiple sample locations. At location SW-WD-12, PRGs were exceeded much less than at other locations, most likely as the result of dilution of the Western Drainage water. The drainage reaches exceeding surface water PRGs are presented in Figure 3.

7.6 Sediment

Sediment sample locations other than the background location SD-WD-05 and SD-WD-03 exceeded at least one PRG (Figure 4). Zinc had the most and greatest exceedances of PRGs, followed by cadmium and lead (see Table III-11 of the Remedial Investigation Report; ENVIRON 2005). Copper, mercury, and silver also exceeded PRGs. The sample locations in the creek downstream of the Western Drainage (SD-WD-1, SD-WD-2, SD-WD-3, and SD-WD-4) marginally exceeded the zinc PRG. Likewise, several sample locations in the Eastern Drainage (SD-ED-11, SD-ED-12, and SD-ED-15) marginally exceeded the zinc PRG. The total length of stream exceeding the PRGs is 13,500 feet.

8 Development of Remedial Alternatives

The remedial technologies and process options that were retained in the FS (ENVIRON 2006b) were used in developing the remedial alternatives below.

The majority of the remedial components directly address the residue piles and soil exceeding PRGs. Groundwater RAOs are addressed by remedial components that reduce or eliminate leaching of COCs to groundwater (that is, immobilization, offsite disposal of residue piles, regrade, and an ARAR-appropriate cover). Regrading and ARAR-appropriate covers reduce infiltration through decreased permeability of surface soil (relative to residue) and increased evapotranspiration. Direct treatment of groundwater for restoration is not included because there is no current or expected future use of the groundwater. In addition, the components listed above may result in relatively rapid reduction in the groundwater plume exceeding PRGs, given the direct connection with rapid infiltration of precipitation through the residue and subsequent discharge to the surface water along the interface of native soil and residue.

Surface water and sediment RAOs are also addressed by remedial components that reduce or eliminate leaching of COCs to groundwater because the contaminated groundwater subsequently discharges to surface water and is at least partially responsible for exceedances of surface water and sediment PRGs. Regrading and ARAR-appropriate covers will reduce erosion of residue and soil exceeding PRGs into the drainageways. Eventually, the sediments exceeding PRGs will be covered with more recent sediments that meet PRGs. In addition to the remedial components listed above that reduce infiltration, Alternative 5 adds in situ treatment of groundwater along the drainageways to reduce discharge of inorganics to surface water. Direct remediation of sediment is not included as a remedial

technology because the ecological risk assessment concluded that adverse impacts to ecological receptors are not likely occurring under current conditions. The RAO for sediment is to minimize impacts to aquatic receptors if aquatic habitat improves in the future, which is best met through institutional controls (ICs) that require monitoring of aquatic habitat and improvements in surface water and sediment conditions as a result of the residue pile, soil, and groundwater remedial components.

The developed remedial alternatives are summarized in Table 9. The following sections provide a list of the main components of each alternative. Further detailed descriptions of remedial components will be provided in a subsequent TM.

TABLE 9
Development of Remedial Alternatives
Eagle Zinc TM-1

Remedial Technologies	Alternative				
	1	2	3	4	5
	No Action	Immobilization, Regrade, and ARAR-Appropriate Cover	Regrade, ARAR-Appropriate Cap, and Cover	Offsite Disposal, Regrade, and ARAR-Appropriate Cover	Offsite Disposal of All Residue Piles, Regrade, and ARAR-Appropriate Cover Over All Residue, In Situ Groundwater Treatment
Institutional controls to control exposures to residue and soil		X	X	X	X
Monitoring and assessment of groundwater, surface water, and habitat		X	X	X	X
Consolidation and soil cover of 11 residue piles and soil area greater than PRGs		X	X	X	
Onsite immobilization of residue piles NP-14, RR1-3, and MP1-21		X			
Cap (RCRA low permeable cap) residue piles NP-14, RR1-3, and MP1-21			X		
Offsite disposal of residue piles NP-14, RR1-3, and MP1-21				X	X
Offsite disposal of 11 residue piles and soil area greater than PRGs					X
Regrade and soil cover over southwest area of site			X	X	
Regrade and soil cover over all residue					X
In situ treatment of groundwater					X

8.1 Alternative 1—No Action

The objective of Alternative 1, the No Action Alternative, is to provide a baseline for evaluation of remedial alternatives, as required by the NCP. Under this alternative, there would be no additional remedial actions conducted at the site to control the continued release of and exposure to contaminants. There would be a risk to industrial and construction workers from direct contact with the residue piles and soil in the southwest area of the site. Leaching to groundwater with resulting groundwater PRG exceedances would continue, and groundwater discharge to surface water would continue to cause surface water PRG exceedances. Sediment would remain as a potential risk to ecological

receptors. Also, the buildings would remain and continue to deteriorate and potentially pose risks to the environment.

8.2 Alternative 2—Immobilization, Regrade, and ARAR-Appropriate Cover

The main components of Alternative 2 are as follows.

8.2.1 Institutional Controls

Restrictive covenants would be added to the property deed to notify future owners that residue and soil are present onsite that pose risks to human health and the environment. The current restrictive covenant that prevents use of onsite groundwater would be maintained. Future excavation activities would require a health and safety plan and disposal of excavated material in accordance with all applicable laws and regulations.

8.2.2 Monitoring and Assessment

Due to the ICs, routine monitoring of groundwater, surface water, and habitat quality will be performed at least on an annual basis. A site development plan would also specify future industrial development restrictions, for example, that an ARAR-appropriate cover is required for all exposed residue not otherwise covered by facilities such as buildings, roadways, or parking lots.

8.2.3 Consolidation and ARAR-Appropriate Cover of 11 Residue Piles and Soil Area Greater than PRGs

Eleven residue piles (see Table 7 for pile numbers) and the area of soil around sample location A1-3-S1 exceeding industrial direct contact PRGs would be consolidated onsite into one or more areas and covered with at least 1 foot of soil and revegetated. The location and dimensions of the consolidation area would be determined during design and would be consistent with future site development.

8.2.4 Onsite Immobilization of Residue Piles NP-14, RR1-3, and MP1-21

These three residue piles would be treated using immobilization agents to meet the SPLP PRGs for cadmium, lead, and zinc and consolidated in one area of the site and covered with at least 1 foot of soil and revegetated. Immobilization agents would prevent further leaching of cadmium, lead, and zinc to groundwater. The location and dimensions of the consolidation area would be determined during design and would be consistent with future site development.

8.3 Alternative 3—Regrade, ARAR-Appropriate Cap, and ARAR-Appropriate Cover

The main components of Alternative 3 are as follows.

8.3.1 Institutional Controls

Same as Alternative 2.

8.3.2 Monitoring and Assessment

Same as Alternative 2.

8.3.3 Consolidation and ARAR-Appropriate Cover of 11 Residue Piles and Soil Area Greater than PRGs

Same as Alternative 2.

8.3.4 ARAR-Appropriate Cap Residue Piles NP-14, RR1-3, and MP1-21

These three residue piles would be consolidated into one area and capped with an ARAR-compliant low-permeability cap to minimize infiltration through the residue, promoting runoff and evapotranspiration.

8.3.5 Regrade and ARAR-Appropriate Cover over Southwest Area

The 20-acre area in the southwest portion of the site would be regraded to reduce erosion and promote runoff and covered with at least 1 foot of soil to establish a vegetative cover. The objective would be to reduce erosion of residue and reduce infiltration and leaching of COCs to groundwater, which could potentially migrate to offsite surface water. This area overlies the area of groundwater exceeding cadmium and lead PRGs and is believed to be the main area contributing to surface water exceedances of PRGs.

8.4 Alternative 4—Offsite Disposal, Regrade, and ARAR-Appropriate Cover

The main components of Alternative 4 are as follows.

8.4.1 Institutional Controls

Same as Alternative 2.

8.4.2 Monitoring and Assessment

Same as Alternative 2.

8.4.3 Consolidation and ARAR-Appropriate Cover of 11 Residue Piles and Soil Area Greater than PRGs

Same as Alternative 2.

8.4.4 Offsite Disposal of Residue Piles NP-14, RR1-3, and MP1-21

These three residue piles would be excavated, treated as necessary to meet land disposal restriction of 0.75 mg/L in the TCLP extract, and disposed offsite in a RCRA Subtitle D landfill.

8.4.5 Regrade and ARAR-Appropriate Cover over Southwest Area

Same as Alternative 3.

8.5 Alternative 5—Offsite Disposal of All Residue Piles, Regrade, and ARAR-Appropriate Cover Over All Residue and In Situ Groundwater Treatment

The main components of Alternative 5 are as follows.

8.5.1 Institutional Controls

Same as Alternative 2

8.5.2 Monitoring and Assessment

Same as Alternative 2

8.5.3 Offsite Disposal of All Residue Piles

All 15 residue piles and the area of soil around sample location A1-3-S1 exceeding direct contact industrial PRGs or PRGs protective of groundwater would be excavated, treated as necessary to meet land disposal restriction of 0.75 mg/L in the TCLP extract, and disposed offsite in a RCRA Subtitle D landfill.

8.5.4 Regrade and ARAR-Appropriate Cover over All Residue

This component is similar to that in Alternative 3, though it would be expanded to include all exposed residue onsite. This area overlies the area of groundwater exceeding groundwater and surface water PRGs. It would reduce exceedances of groundwater PRGs and reduce exceedances of surface water PRGs. It would also contribute to reduced sediment PRG exceedances as a result of erosion of residue.

8.5.5 In Situ Treatment of Groundwater

A permeable reactive barrier wall would be installed parallel to the Eastern and Western Drainage areas in order to protect surface water. It would treat groundwater to reduce the discharge of inorganics exceeding surface water PRGs, in particular cadmium, iron, and zinc that exceed IWQS. The reactive barrier material would be determined based on design studies but may include limestone to reduce groundwater pH and promote metal precipitation or other materials to promote metal adsorption.

9 References

CH2M HILL. 2005. *Eagle Zinc Company Site – Review of Nature, Extent of Contaminants, and Risk Assessments*. August.

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ENVIRON. 2004b. *Human Health Risk Assessment, Remedial Investigation/Feasibility Study, Eagle Zinc Company Site, Hillsboro, Illinois*. March.

ENVIRON. 2004c. *Human Health Risk Assessment (revised), Remedial Investigation/Feasibility Study, Eagle Zinc Company Site, Hillsboro, Illinois*. August.

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ENVIRON. 2006b. *Feasibility Study Report. Eagle Zinc Company Site, Hillsboro, Illinois.* March.

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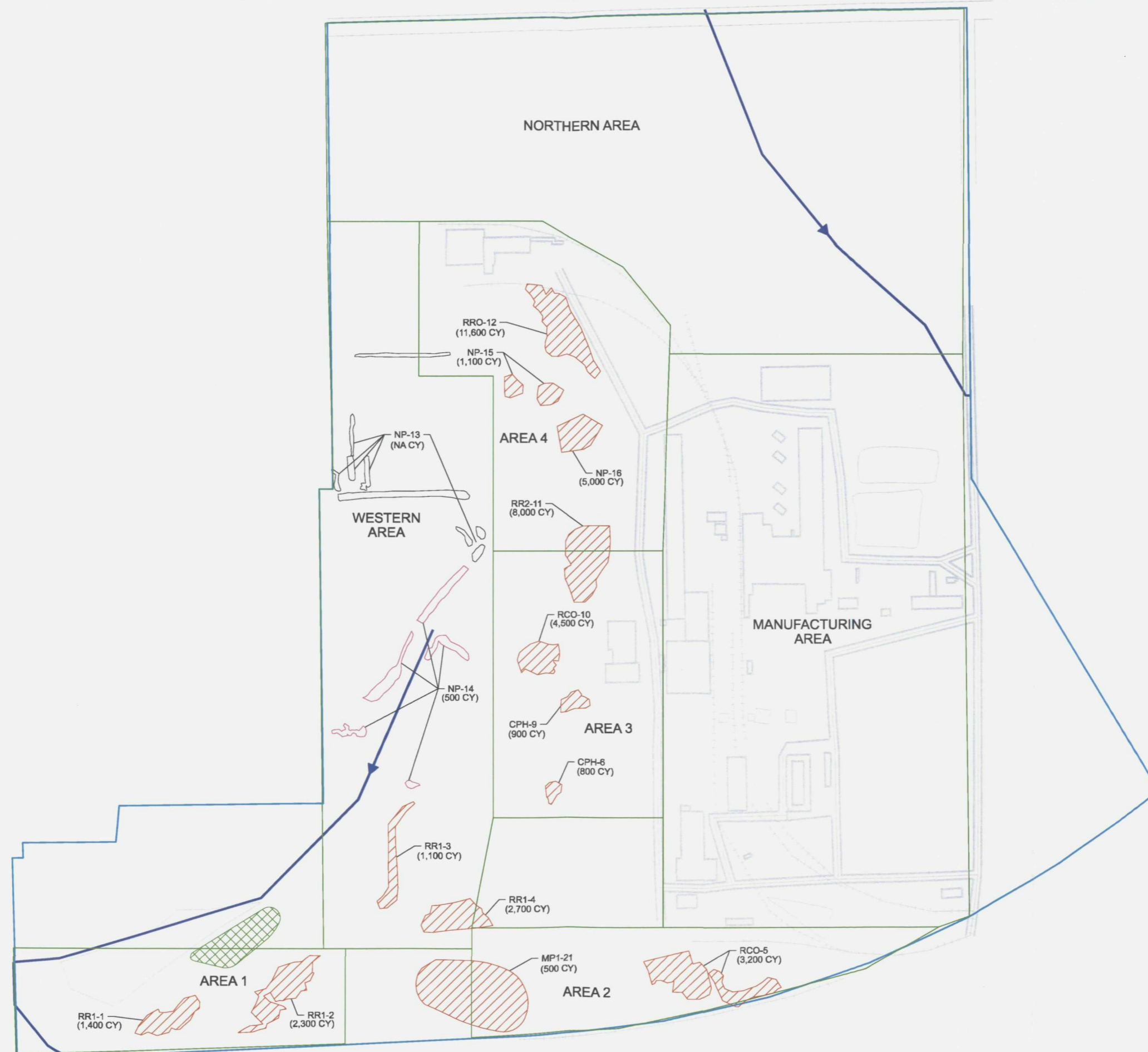
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Figures



LEGEND

- AREA BOUNDARY
- PROPERTY LINE
- (12,930) RESIDUE PILE VOLUME (CY)
- STORMWATER DRAINAGEWAY
- RESIDUE PILE > INDUSTRIAL PRGS
- RESIDUE PILE < INDUSTRIAL PRGS
- SURFACE SOIL > INDUSTRIAL PRGS
- RESIDUE PILE > CD OR P6 SPLP DIRECT CONTACT MCL (MP 1-21, RR 1-3, NP14)
- RR1 = ROTARY RESIDUE TYPE 1
- RR2 = ROTARY RESIDUE TYPE 2
- RCO = ROTARY CLEAN OUT
- RRO = ROTARY RESIDUE OVERSIZE
- CPH = CARBON PLANT HUTCH
- MP = MISCELLANEOUS PILES
- NP = NEWLY IDENTIFIED PILES
- NA = NOT APPLICABLE

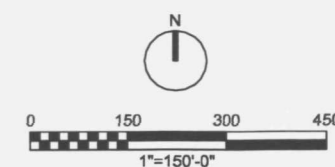
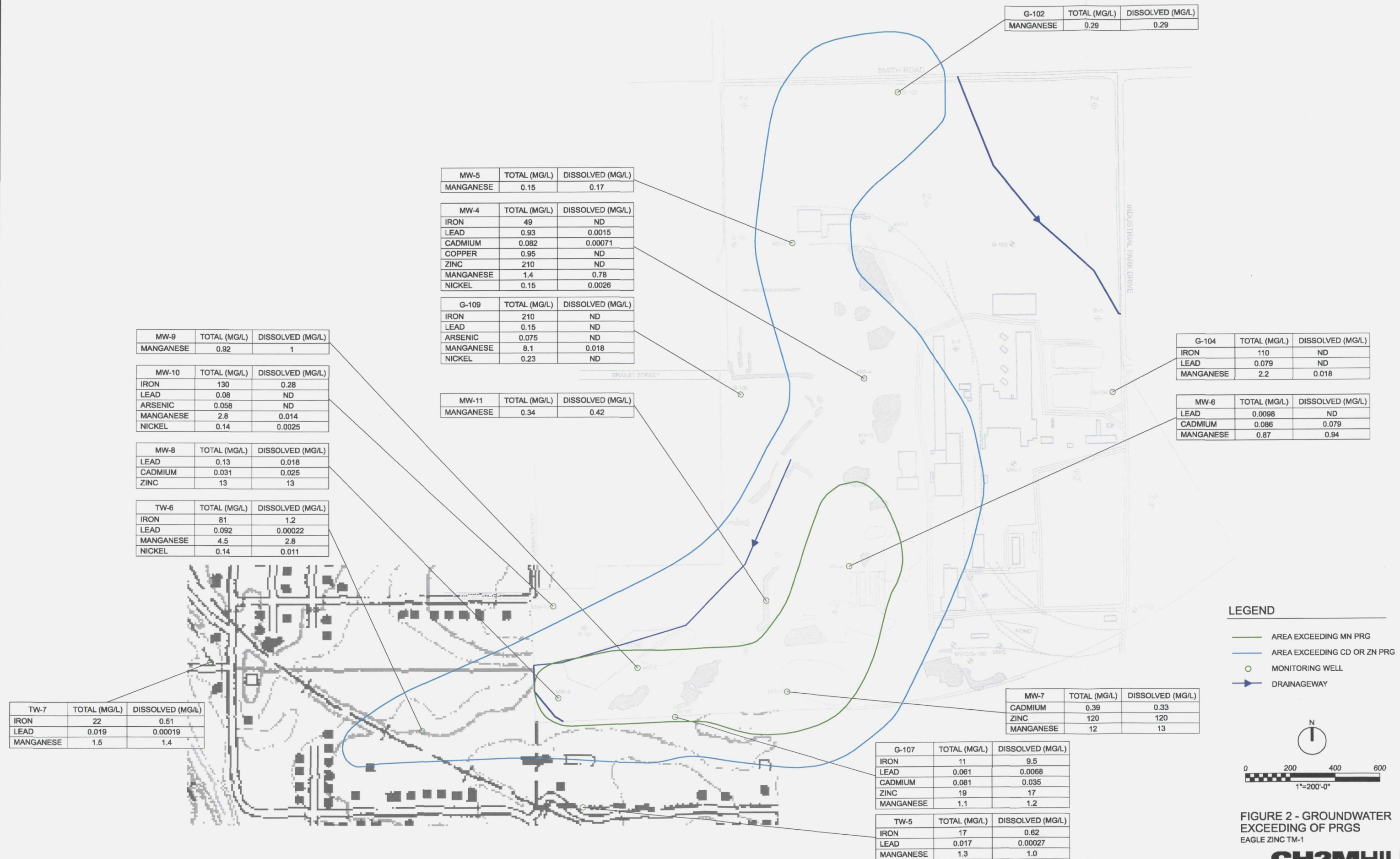


FIGURE 1 - RESIDUE PILES AND SOIL EXCEEDING PRGS
EAGLE ZINC TM-1

CH2MHILL



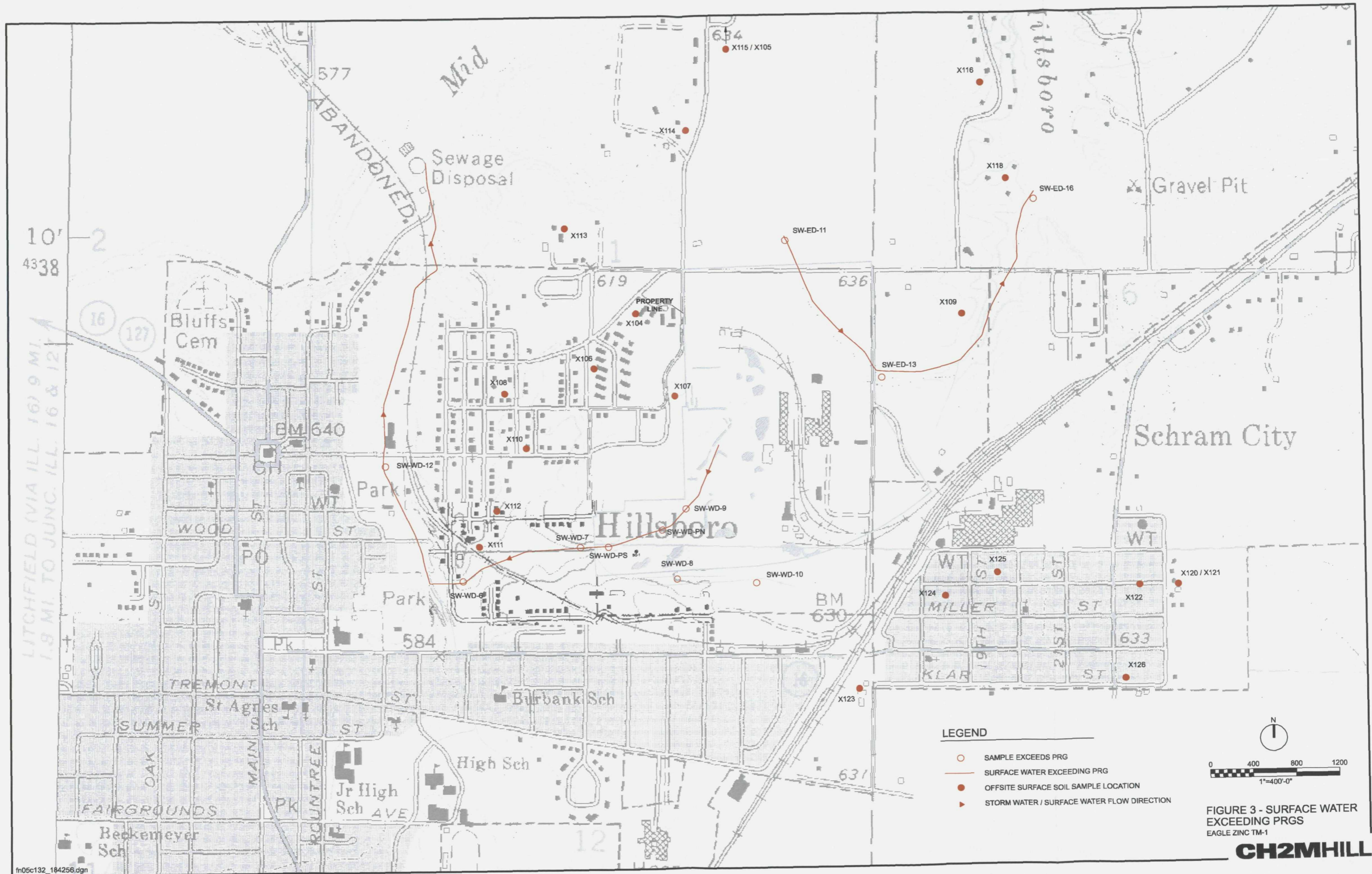
LEGEND

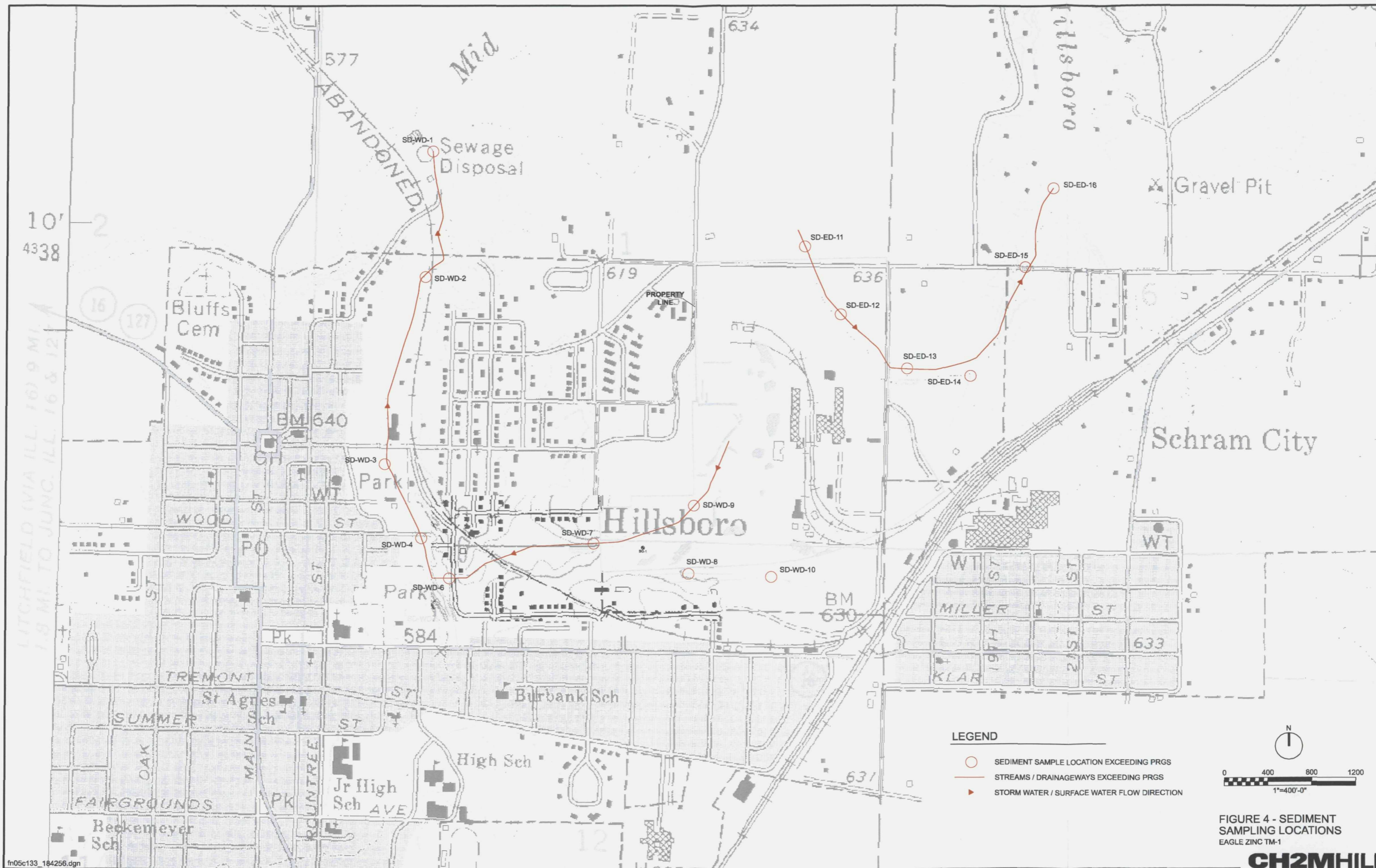
- AREA EXCEEDING MN PRG
- AREA EXCEEDING CD OR ZN PRG
- MONITORING WELL
- DRAINAGEWAY

Scale: 1"=200'-0"

North Arrow: N

FIGURE 2 - GROUNDWATER EXCEEDING OF PRGS
EAGLE ZINC TM-1
CH2MHILL





LEGEND

- SEDIMENT SAMPLE LOCATION EXCEEDING PRGS
- STREAMS / DRAINAGEWAYS EXCEEDING PRGS
- ▶ STORM WATER / SURFACE WATER FLOW DIRECTION

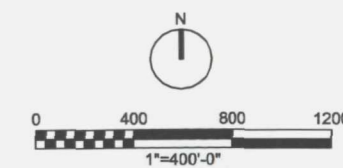


FIGURE 4 - SEDIMENT SAMPLING LOCATIONS
EAGLE ZINC TM-1

CH2MHILL

Appendix A

Potential ARARs

APPENDIX A

Applicable or Relevant and Appropriate Requirements

Eagle Zinc Site TM-1

Regulation	Requirement	ARAR Status	Analysis
<i>Chemical-Specific ARARs</i>			
Soil and Groundwater			
CERCLA Guidance on Land Use in the CERCLA Remedy Selection Process	Establishes appropriate considerations in defining future land use.	TBC	CERCLA provides guidance to USEPA in selecting land use for remedy selection purposes.
Illinois Administrative Code (IAC) Title 35, Part 742 Tiered Approach to Corrective Action Objectives (TACO)	TACO establishes a framework for determining soil and groundwater remediation objectives standards and for establishing institutional controls. Tier 1 remediation objectives are set at 10^{-6} ELCR and HI =1 values. Section 742.900(d) Tier 3 remediation objectives allows cleanup levels within the ELCR range of 10^{-4} to 10^{-6} .	TBC	TACO is a voluntary program and is not required (Part 742.105 (a)). It provides guidance for development of site-specific soil and groundwater remediation objectives. It will be used to establish preliminary remediation goals.
Groundwater			
Safe Drinking Water Act (SDWA)—Maximum Contaminant Levels (MCLs)	CERCLA 121(d) states that a remedial action will attain a level under the SDWA. MCLs are enforceable maximum permissible level of a contaminant which is delivered to any user of a public water system.	ARAR	MCLs are relevant and appropriate for potential drinking water sources per the NCP.
40 CFR 141.61 (organic chemicals)			
40 CFR 141.62 (inorganic chemicals)			
SDWA—Maximum Contaminant Level Goals (MCLGs)	CERCLA 121(d)(2)(A) states that a remedial action attain MCLGs where relevant and appropriate. MCLGs are non-enforceable health goals under the SDWA.	ARAR	Non-zero MCLGs may be relevant and appropriate. MCLGs equal to zero are not appropriate for cleanup of groundwater or surface water at CERCLA sites by USEPA policy (see NCP).
40 CFR 141.50 (organic chemicals)			
40 CFR 141.51 (inorganic chemicals)			

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Regulation	Requirement	ARAR Status	Analysis
SDWA—Secondary MCLs (SMCLs) 40 CFR 143	Non-enforceable limits intended as guidelines for use by states in regulating water supplies. SMCLs are related to aesthetic concerns (e.g., taste and odor) and are not health-related.	TBC	SMCLs may be considered if drinking water use from an aquifer is considered feasible.
Office of Drinking Water; drinking water health advisories	Guidance levels for drinking water issued by the Office of Drinking Water.	TBC	This may be used for chemicals without MCLs if groundwater is to meet drinking water quality.
IAC Title 35, Part 620 Illinois Water Quality Standards (IWQS); Part 620.210; 620.410; IWQS Class I: Potable Resource Groundwater	Groundwater must meet the standards appropriate to the groundwater class as specified in Subpart D/Section 620.401-440. Standards for potential potable water supply.	ARAR	This is applicable to site groundwater. This is not applicable to groundwater 10 feet or less from the ground surface or to groundwater from low permeability formations ($k < 1 \times 10^{-4}$ cm/s or < 150 gpd from a well screened over 15 feet thick). Remedies considered for the site may include development of a groundwater management zone (GMZ), which may allow contaminant concentrations higher than designated for Class I groundwater.
IAC Title 35, Part 620.220; 620.420; IWQS Class II: General Resource Groundwater	Applicable to groundwater compatible with agricultural, industrial, recreational, or beneficial uses and not in Classes I, III, or IV.	ARAR for groundwater within 10 feet of ground surface.	ARAR is for the shallow groundwater migrating along interface of the residue and the original ground surface.
IAC Title 35, Part 620.450(a), Alternative Groundwater Quality Standards—Groundwater Quality Restoration Standards	Applies to groundwater within a GMZ. May allow concentrations higher than designated use after remediation.	ARAR	This is applicable if a GMZ is used.

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Regulation	Requirement	ARAR Status	Analysis
Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration, OSWER Directive No. 9234.2-25, dated September 1993	Applies to groundwater at contaminated sites. Establishes criteria for assessing the technical impracticability of groundwater remediation.	TBC	Groundwater in large areas of residue may make groundwater restoration technically impracticable.
Surface Water			
Federal Water Pollution Control Act as amended by the Clean Water Act of 1977, Section 208(b) 40 CFR Part 131—Water Quality Standards	Establishes water quality criteria for specific pollutants for the protection of human health and aquatic life. These federal water quality criteria are non-enforceable guidelines used by the state to set water quality standards for surface water.	TBC	Water quality criteria are TBCs used in assessing impacts to surface water and in setting standards for discharges to surface water from a treatment system.
IAC Title 35, Part 302, Illinois Water Quality Standards General Use—Subpart B Sections 302.201-212	Section 11 of Environmental Protection Act—Regulations to restore, maintain, and enhance purity of the water of the state. Waters of state for which there is no specific designation include: • Acute standards apply within mixing zone • Chronic apply after mixing zone	Possible ARAR	This applies to Illinois surface waters that do not have a specific use category, such as the east and west drainageways onsite.
IAC Title 35, Part 302, Public and food processing water supply—Subpart C; Sections 302.301-305	Applies to waters of state designated for waters drawn for treatment and distribution as a potable supply or food processing at the point of withdrawal.	Possible ARAR	This applies at the point of water withdrawal.
IAC Title 35, Part 304 Effluent Standards	Designates specific effluent limits for discharges to surface water.	Possible ARAR	ARAR if remedial alternative includes discharge to surface water. Substantive requirements must be met for discharges to surface water of treatment system water.
IAC Title 35, Part 309 Permits	Designates process used in setting NPDES effluent limits for discharges to surface water.	Possible ARAR	ARAR if remedial alternative includes discharge to surface water. Substantive requirements must be met for discharges to surface water of treatment system water.

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Regulation	Requirement	ARAR Status	Analysis
Air			
IAC Title 35, Subtitle B: Air Pollution	Regulations contain specific requirements that pertain to allowable emissions of criteria pollutants from a number of air contaminant source categories and processes.	Possible ARAR	ARAR if remedial alternative results in air emissions. Substantive requirements for air emission control must be met.
IAC Title 35, Part 212 Visible and Particulate Matter Emissions	Regulations contain specific requirements that pertain to allowable emissions of fugitive particulate matter.	ARAR	Dust control must be implemented to control visible particulate emissions during construction activities.
IAC Title 35, Part 245 Odors	Regulations specify how to determine whether a nuisance odor is present.	ARAR	Odor control may be necessary if it is determined that a nuisance odor is present.
Location-Specific ARARs			
Endangered Species Act of 1973 16 USC §1531 et seq. 50 CFR 200	Requires that federal agencies ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.	No likely ARAR	The ecological risk assessment did not identify threatened or endangered species onsite.
National Historical Preservation Act 16 USC §661 et seq. 36 CFR Part 65	Establishes procedures to provide for preservation of scientific, historical, and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. If scientific, historical, or archaeological artifacts are discovered at the site, work in the area of the site affected by such discovery will be halted pending the completion of any data recovery and preservation activities required pursuant to the act and its implementing regulations.	Not likely ARAR	This may be an ARAR during the remedial activities if scientific, historic, or archaeological artifacts are identified during implementation of the remedy.

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Regulation	Requirement	ARAR Status	Analysis
Protection of Wetlands— Executive Order 11990 50 CFR Part 6, Appendix A	Requires actions to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available. If none is available, effects from implementing the chosen alternative must be mitigated. Public notice and review of activities involving wetlands is required.	ARAR	The ecological risk assessment noted the presence of wetlands associated with the southwest pond.
Executive Order 11983 50 CFR Part 6, Appendix A	Requires actions to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains.	TBC	The site is not within a floodplain.
Action-Specific ARARs/TBC			
Fish and Wildlife Coordination Act (16 USC 661 et seq.)	The Act provides protection and consultation with the U.S. Fish and Wildlife Service and state counterpart for actions that would affect streams, wetlands, other water bodies, or protected habitats. Action taken should protect fish or wildlife, and measures should be developed to prevent, mitigate, or compensate for project-related losses to fish and wildlife.	TBC	The Act is considered an ARAR for construction activities performed during the implementation of remedies that may affect the drainageways.
Occupational Safety and Health Act (29 USC 61 et seq.)	The Occupational Safety and Health Act was passed in 1970 to ensure worker safety on the job. The U.S. Department of Labor oversees the Act. Worker safety at hazardous waste sites is specifically addressed under 29 CFR 1910.120: Hazardous Waste Operations and Emergency Response; general worker safety is covered elsewhere within the law.	TBC	The Act is considered an ARAR for construction activities performed during the implementation of remedies.

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Regulation	Requirement	ARAR Status	Analysis
Clean Air Act; National Ambient Air Quality Standards (NAAQS) Section 109 40 CFR 50-99	<p>The Clean Air Act is intended to protect the quality of air and promote public health. Title I of the Act directed USEPA to publish national ambient air quality standards for "criteria pollutants." In addition, USEPA has provided national emission standards for hazardous air pollutants under Title III of the Clean Air Act. Hazardous air pollutants are designated hazardous substances under CERCLA.</p> <p>The Clean Air Act amendments of 1990 greatly expanded the role of National Emission Standards for Hazardous Air Pollutants by designating 179 new hazardous air pollutants and directed USEPA to attain <i>maximum achievable control technology</i> standards for emission sources. Such emission standards are potential ARARs if remedial technologies (such as incinerators or air strippers) produce air emissions of regulated hazardous air pollutants.</p> <p>Specifies requirements for air emissions such as particulates, sulfur dioxide, VOCs, hazardous air pollutants, and asbestos.</p>	ARAR	The Act is considered an ARAR for remedies that involve creation of air emissions, such as excavation activities that might create dust.
Hazardous Materials Transportation Act; 49 CFR 100-109 Transportation of Hazardous Materials	Specific DOT requirements for labeling, packaging, shipping papers, and transport by rail, aircraft, vessel, and highway.	Possible ARAR	Offsite shipment of hazardous waste may occur.
Resource Conservation and Recovery Act (RCRA), (42 USC 321 et seq.)	RCRA was passed in 1976. It amended the Solid Waste Disposal Act by including provisions for hazardous waste management. Authority for implementation of RCRA in Illinois was given to the State of Illinois. See Illinois ARARs below under IAC Title 35 Parts 720 to 730.	Possible ARAR	There is no documented evidence of disposal of listed hazardous waste at the site. Soil excavated for onsite ex situ treatment or offsite disposal may however be characteristic hazardous waste. See Illinois ARARs below for more details of specific requirements.

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Regulation	Requirement	ARAR Status	Analysis
40 CFR 268, Land Disposal Restrictions	The land disposal restrictions require treatment before land disposal for a wide range of hazardous wastes.	Possible ARAR	This is an ARAR for disposal of hazardous waste. It is applicable to soils that are a characteristic hazardous waste or that contain a listed waste. Contaminated soils must meet the higher of 10 times the universal treatment standard or a 90 percent reduction of the contaminant concentration.
IAC Title 35, Environmental Protection, Subtitle B: Air Pollution	This part describes permits and emission standards to protect air quality.	ARAR	This part is considered an ARAR for remedies that involve creation of air emissions, such as excavation activities that might create dust.
IAC Title 35, Part 212, Subpart K, Fugitive Particulate Matter	Site construction and processing activities would be subject to Sections 212.304 to 212.310 and 212.312 which relate to dust control.	ARAR	Remedial action may generate fugitive dust. Rules require dust control for storage piles, conveyors, onsite traffic, and processing equipment. An operating program (plan) is required and is to be designed for significant reduction of fugitive emissions.
IAC Title 35, Subtitle G: Waste Disposal, Subchapter c: Hazardous Waste Operating Requirements, Parts 720- 729	<p>RCRA was passed in 1976. It amended the Solid Waste Disposal Act by including provisions for hazardous waste management. The statute sets out to control the management of hazardous waste from inception to ultimate disposal. RCRA is linked closely with CERCLA, and the CERCLA list of hazardous substances includes all RCRA hazardous wastes.</p> <p>RCRA applies only to remedies that generate hazardous waste. IEPA has been given authorization to implement RCRA in Illinois.</p> <p>Standards applicable to hazardous waste generators, transporters and operators of hazardous waste treatment storage and disposal facilities.</p>	Possible ARAR	There is no documented evidence of disposal of listed hazardous waste at the site. Residue or soil excavated for onsite ex situ treatment or offsite disposal may however be characteristic hazardous waste.

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Regulation	Requirement	ARAR Status	Analysis
IAC Title 35, Subchapter c, Hazardous waste Operating Requirements; Part 721 Identification and Listing of Hazardous Waste	Soils must be managed as hazardous waste if they contain listed hazardous waste or are characteristic hazardous waste. Management of treatment residuals subject to RCRA if residuals retain characteristic.	Possible ARAR	There is no documented evidence of disposal of listed hazardous waste at the site. Soil excavated for onsite ex situ treatment or offsite disposal may however be characteristic hazardous waste.
IAC Title 35, Subchapter c, Part 722; Standards Applicable for Generators of Hazardous Waste	Establishes regulation covering activities of generators of hazardous wastes. Requirements include identification number, record keeping, and use of uniform national manifest.	Possible ARAR	This is applicable if wastes are RCRA hazardous and are transported offsite.
IAC Title 35, Subchapter c, Part 723 Standards Applicable for Transporters of Hazardous Waste	The transport of hazardous waste is subject to requirements <i>including DOT regulations, manifesting, record keeping, and discharge cleanup.</i>	Possible ARAR	This is applicable if wastes are RCRA hazardous and are transported offsite.
IAC Title 35, Subchapter c, Part 724.110 to 724.119 Subpart B—General Facility Standards	General requirements and application of Section 264 standards.	Not likely an ARAR	This is applicable if a RCRA hazardous waste disposal facility is constructed onsite.
IAC Title 35, Subchapter c, Part 724.190 to 724.201 Subpart F—Releases from Solid Waste Management Units	Requirements for wastes contained in solid waste management units.	TBC	Investigation and remediation is performed under the USEPA Superfund program with RCRA requirements for SWMUs as TBCs.
IAC Title 35, Subchapter c, Part 724.210 to 724.220 Subpart G—Closure and Post-closure	General closure and post-closure care requirements. Closure and post-closure plans (including operation and maintenance), site monitoring, record keeping, and site use restriction.	TBC	RCRA is not an ARAR for closure of the site because the site is not a RCRA hazardous waste treatment, storage, or disposal facility. Hazardous wastes are not known to be present onsite.
IAC Title 35, Subchapter c, Part 724.270 to 724.279 Subpart I—Use and Management of Containers	Standards applicable for owners and operators of hazardous waste facilities that store containers of hazardous waste.	Possible ARAR	This is an ARAR if the remedy uses containers for storage of hazardous waste.

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Regulation	Requirement	ARAR Status	Analysis
IAC Title 35, Subchapter c, Part 724.290 to 724.300 Subpart J—Tank Systems	Standards applicable for owners and operators that use tank systems for storing or treating hazardous waste.	Possible ARAR	ARAR if remedy uses tanks for storage of hazardous waste such as liquids which exceed TCLP limits.
IAC Title 35, Subchapter c, Part 724.320 to 724.332 Subpart K—Surface Impoundments	Standards applicable for owners and operators that use surface impoundments to treat, store, or dispose of hazardous waste.	Not a likely ARAR	Surface impoundments are not likely a remedial action.
IAC Title 35, Subchapter c, Part 724.350 to 724.359 Subpart L—Waste Piles	Requirements for hazardous waste kept in piles. Requirements include liner and leachate collection unless in a container or structure.	Not likely an ARAR	Waste piles are not likely a remedial action.
IAC Title 35, Subchapter c, Part 724.370 to 724.383 Subpart M—Land Treatment	Standards applicable for owners and operators of facilities that treat or dispose of hazardous waste in land treatment units.	Not likely an ARAR	Land treatment is not likely a remedial action.
IAC Title 35, Subchapter c, Part 724.400 to 724.417 Subpart N—Landfills	Regulations for owners and operators of facilities that dispose of hazardous waste in landfills. Requirements for design, operation, and maintenance of hazardous waste landfills.	Not likely an ARAR	This is not an ARAR. Landfill is not a likely remedial action.
IAC Title 35, Subchapter c, Part 724.440 to 724.451 Subpart O—Incinerators	Standards applicable for owners and operators of hazardous waste incinerators.	Not likely an ARAR	Onsite incineration is not a likely remedial action.
IAC Title 35, Subchapter c, Part 724.650 to 724.655 Subpart S—Special Provisions for Cleanup	Standards applicable for corrective action management units, temporary units, and staging piles.	ARAR	Staging piles or temporary units may be needed for residue that may be a characteristic hazardous waste.
IAC Title 35, Subchapter c, Part 724.700 to 724.703 Subpart X—Miscellaneous Units	Standards applicable for owners and operators that treat, store, or dispose of hazardous waste in miscellaneous units.	Not likely an ARAR	Other units for treatment, storage, or disposal of hazardous waste are not likely to be a part of remedial actions.

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Regulation	Requirement	ARAR Status	Analysis
IAC Title 35, Subchapter c, Part 728	Identifies land disposal restrictions and treatment requirements for materials subject to restrictions on land disposal. Must meet waste-specific treatment standards prior to disposal in a land disposal unit.	Possible ARAR	This is an ARAR for disposal of hazardous waste. This is applicable to residue or soils that are a characteristic hazardous waste or that contain a listed waste. Contaminated soils must meet the higher of 10 times the universal treatment standard or a 90 percent reduction of the contaminant concentration.
IAC Title 35, Environmental Protection, Subtitle G: General Provisions, Chapter I: Pollution Control Board, Subchapter d: Underground Injection Control and Underground Storage Tank Programs; Parts 730 and 738	Underground injection control and underground storage tank programs.	Not a likely ARAR	These regulations would be an ARAR for remedies involving use of wells for injection of materials to accelerate remediation or reinjection of treated groundwater, remedies that require installation of an underground storage tank, or remedies that reinject treated water. None of these are likely remedial components.
IAC Title 35, Subtitle G: Subchapter f: Part 740 Site Remediation Program	Presents requirements for the site remediation program.	TBC	The Illinois site remediation program requirements under Part 740 are specifically excluded for sites on the NPL (740.105—Applicability).
IAC Title 35, Subtitle G: Subchapter f: Site Remediation Program, Section 740.530 Establishment of Groundwater Management Zones	Presents requirements for establishment of groundwater management zones (GMZs). GMZs are three-dimensional areas where groundwater exceeds the groundwater standards of IAC Title 35 Part 620.	TBC	The Illinois site remediation program requirements under Part 740 are specifically excluded for sites on the NPL (740.105—Applicability).
IAC Title 35, Subtitle G: Subchapter f: Site Remediation Program, Section 740.535 Establishment of Soil Management Zones	Presents requirements for establishment of soil management zones (SMZs). SMZs can be used for onsite placement of contaminated soils for structural fill or land reclamation or consolidation of contaminated soils within a remediation site. Soil with contaminants exceeding criteria cannot be placed in areas of soil meeting criteria.	TBC	The Illinois site remediation program requirements under Part 740 are specifically excluded for sites on the NPL (740.105—Applicability).

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Regulation	Requirement	ARAR Status	Analysis
IAC Title 35, Subtitle G: Subchapter f: Part 742. Tiered Approach to Remedial Action Objectives	<p>The purpose of this part is to establish the procedures for investigative and remedial activities at sites where there is a release, threatened release, or suspected release of hazardous substances, pesticides, or petroleum, and for the review of those activities; establish procedures to obtain IEPA review and approval of remediation costs for the environmental remediation tax credit; and establish and administer a program for the payment of remediation costs as a brownfield site.</p> <p>Presents requirements for the tiered approach to corrective action objectives (TACO). Tier 1 remediation objectives are set at 10^{-6} ELCR and HI = 1 values. Section 742.900(d) Tier 3 remediation objectives allows cleanup levels within the ELCR range of 10^{-4} to 10^{-6}.</p>	TBC	TACO is a voluntary program and is not required (Part 742.105 (a)). It provides guidance for development of site-specific soil and groundwater remediation objectives. This will be used to establish preliminary remediation goals.
IAC Title 35, Subtitle G: Subchapter f: Tiered Approach to Remedial Action Objectives. Subpart J Institutional Controls. Part 742 1000 to 742.1020	Provides requirements for when ICs are needed and presents requirements for implementation of ICs. ICs are needed when land use is assumed to be industrial or commercial, risk exceeds a HI = 1 or ELCR > 1×10^{-6} , engineered barriers are used, exposure routes are excluded, or when the point of exposure requires control.	TBC	This provides guidance for development of ICs. TACO is a TBC since it is not required.

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Regulation	Requirement	ARAR Status	Analysis
IAC Title 35, Subtitle G: Subchapter f: Tiered Approach to Remedial Action Objectives. Subpart J Engineered Barriers, Part 742.100 to 742.1105	<p>Provides requirements for engineered barriers. Barriers include the following:</p> <ul style="list-style-type: none"> • Soil component of groundwater pathway: (1) caps or walls consisting of clay, asphalt, or concrete; or (2) permanent structures such as buildings or highways. • Soil ingestion pathway: (1) caps or walls consisting of clay, asphalt, or concrete; (2) permanent structures such as buildings or highways; or (3) uncontaminated soil, sand, or gravel that is at least 3 feet thick. • Soil inhalation pathway: (1) caps or walls consisting of clay, asphalt, or concrete; (2) permanent structures such as buildings or highways; or (3) uncontaminated soil, sand, or gravel that is at least 10 feet thick. 	TBC	This provides guidance for development of ICs. TACO is a TBC since it is not required.
IAC Title 35, Subtitle G: Subchapter h: Illinois "Superfund" Program; Part 750 Illinois Hazardous Substances Pollution Contingency Plan	Establishes requirements for investigation and remediation of sites where there has been a release or a substantial threat of a release of a hazardous substance. Parallels USEPA's Superfund program.	TBC	This is not an ARAR. The Illinois Hazardous Substances Pollution Contingency Plan is applicable to state response taken at sites that are not the subject of a federal response taken pursuant to CERCLA.
IAC Title 35, Parts 807-810 Solid Waste and Special Waste Hauling	This part describes requirements for solid waste and special waste hauling. Special waste must be treated, stored, or disposed at a facility permitted to manage special waste. Presents the special waste classes and the method to determine whether the solid waste is a special waste and if so, whether it is Class A (all non-Class B special wastes) or Class B (low or moderate hazard special wastes). RCRA hazardous waste is not included within the special waste classes.	ARAR	This is an ARAR for disposal of solid waste and special waste. Contaminated residue or soil that is not a RCRA hazardous waste would be evaluated to determine whether it is a Class A or B special waste. Offsite disposal of special waste must be at a solid waste landfill permitted to receive that special waste class unless IEPA specifically allows otherwise.

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Regulation	Requirement	ARAR Status	Analysis
IAC Title 35, Part 811 Applies to All New Landfills	Requirements for new solid waste landfills.	Possible ARAR	This is an ARAR if a new solid waste landfill is a remedial action.
IAC Title 35, Subpart A—General Standards for All Landfills	Location standards, operating standards, and closure and post-closure maintenance.	Possible ARAR	This is an ARAR if a new solid waste landfill is a remedial action.
IAC Title 35, Subpart C— Putrescible and Chemical Waste Landfills General	Location standards, liner and leachate collection system requirements, and final cover requirements.	Possible ARAR	This is an ARAR if a new solid waste landfill is a remedial action.
IAC Title 35, Subpart C— Putrescible and Chemical Waste Landfills Facility Location (811.302)	Location of landfill including setback zone, proximity to sole source aquifer, residences, schools, hospitals, or runways.	Possible ARAR	This is an ARAR if a new solid waste landfill is a remedial action.
IAC Title 35, Subtitle H: Part 300 Noise	Regulations contain specific requirements that pertain to nuisance noise levels.	Possible ARAR	This is an ARAR. Noise levels will need to be controlled if noise reaches nuisance levels.

ARAR applicable or relevant and appropriate requirement
 CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
 CFR Code of Federal Regulations
 cm/s centimeters per second
 DOT Department of Transportation
 ELCR excess lifetime cancer risk
 GMZ groundwater management zone
 gpd gallons per day
 HI hazard index
 IAC Illinois Administrative Code
 IC institutional control
 IEPA Illinois Environmental Protection Agency
 IWQS Illinois Water Quality Standards
 MCL maximum contaminant level

MCLG maximum contaminant level goal
 NAAQS National Ambient Air Quality Standards
 NCP National Contingency Plan
 NPDES National Pollutant Discharge Elimination System
 RCRA Resource Conservation and Recovery Act
 SDWA Safe Drinking Water Act
 SMCL secondary maximum contaminant level
 SMZ soil management zone
 SWMU solid waste management unit
 TACO Tiered Approach to Corrective Action Objectives
 TBC to be considered
 USC United States Code
 USEPA United States Environmental Protection Agency
 VOC volatile organic compound